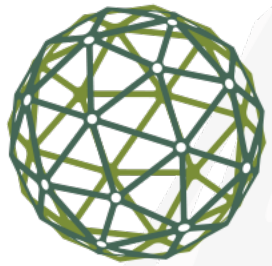

8th International Conference on BIG DATA & Data Science for Official Statistics

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Big Data in Greening Transport

Department for Transport, UK

Sam Rose 13.06.24

United Nations BigData

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GOBIERNO DE ESPAÑA MINISTERIO DE ASUNTOS EXTERIORES, UNIÓN EUROPEA Y COOPERACIÓN

BC3 BASQUE CENTRE FOR CLIMATE CHANGE Klima Aldaketa Ikergai

EXCELENCIA MARÍA DE MAEZTU 2023-2027

INE Instituto Nacional de Estadística

Eustat EUSKAL ESTATISTIKA ERAKUNDEA INSTITUTO VASCO DE ESTADÍSTICA

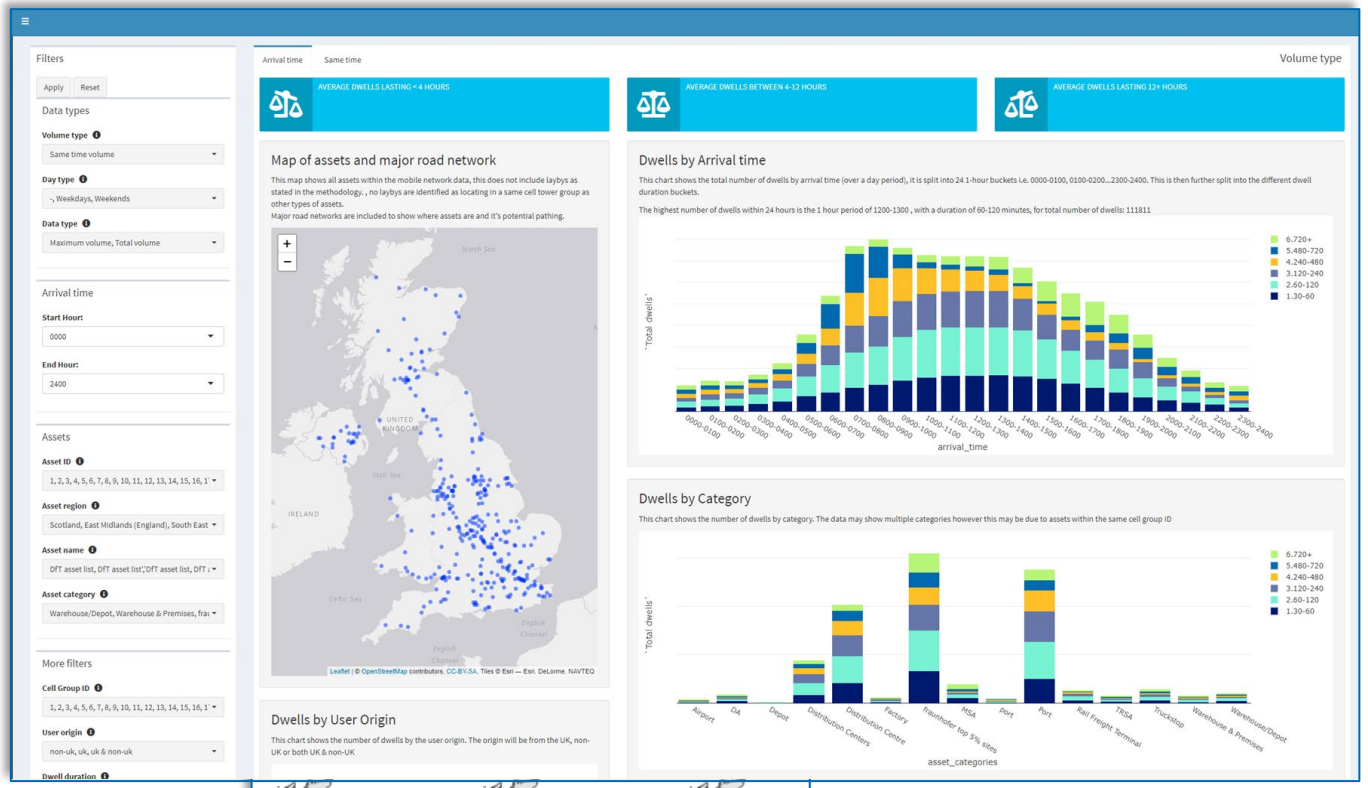
Filling data gaps

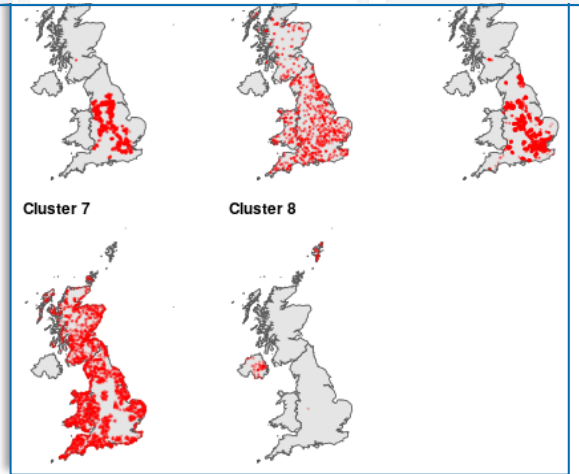
1. Freight movement – Mobile data

Can we use mobile network data to gain insights on Heavy Goods Vehicle dwelling behaviour?

Analysis:

- Procured aggregated and anonymised **mobile network operator data** on HGV dwells at sites across the UK
- Used to understand **patterns in dwelling behaviour** at different times of day and locations.
- **Comparative analysis** with other departmental sources to understand validity
- Enabled **K-means clustering** of dwelling locations to identify similar sites
- Development of **dashboard to facilitate sharing** data and exploratory analysis





2. Freight stops – Earth Observation AI

Can Artificial Intelligence (Computer Vision) be used to detect HGVs in Earth Observation imagery?

Analysis:

- Procured **high end satellite imagery** (0.3m resolution images) through a cross government Geospatial Commission pilot
- Generation of in-house **high-quality annotations** of satellite imagery as training data for models
- Building an objection detection proof-of-concept model using an **ensemble of region based convolutional neural networks (CNNs)** and transfer learning available through **Cloud Services** to identify classes of HGVs
- Precision score of **79%** on detections (of every 10 HGVs predicted by our model, 7 are definite HGVs)

Potential Impact

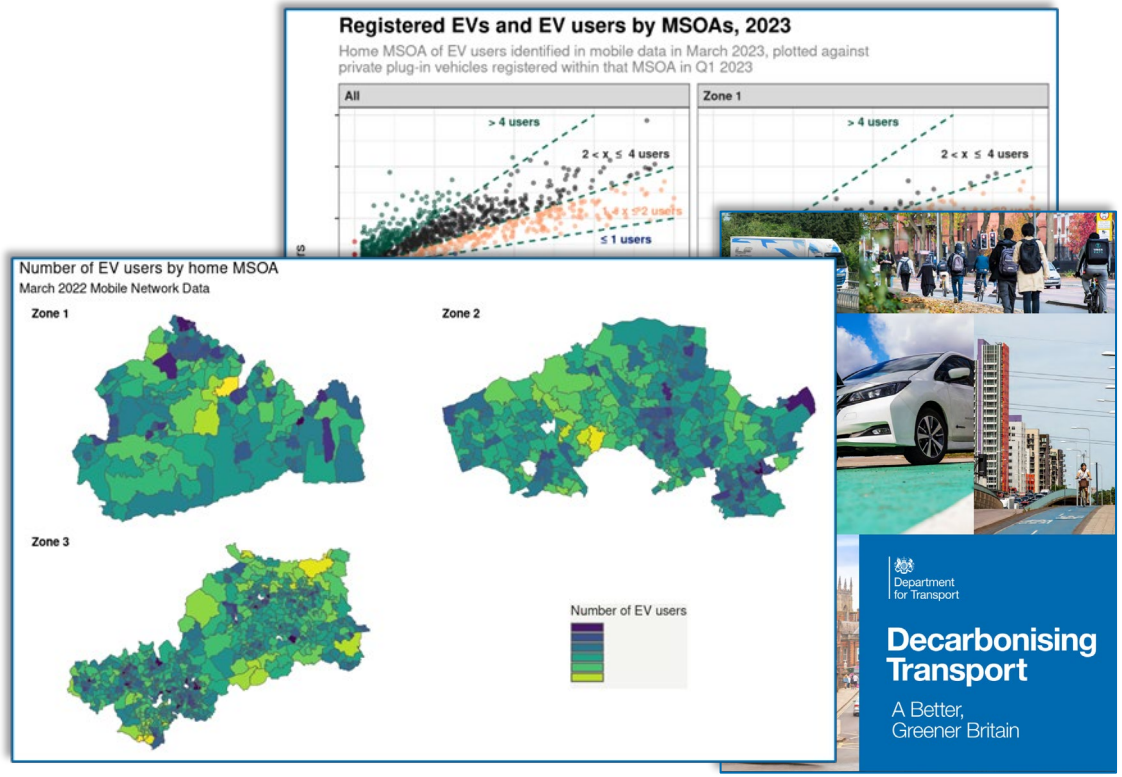
"The precision score currently achieved means that we are already able to identify previously unknown clusters of HGVs that might be otherwise undetected."

3. Electric Vehicle usage

Can mobile network and sdk data provide sufficiently robust evidence to support evaluation of EV uptake, usage and interventions in the context of the wider Transport Decarbonisation Plan?

Analysis:

- Procured aggregated and anonymised **mobile network operator data** focused on journeys made by plug-in vehicles
- **Comparative analysis** of this with existing government sources, which shows data is representative and helps understand limitations
- Analysis of **trends and differences** in EV usage compared to other road vehicles
- Next steps include expanding analysis to wider geographical area with **focus on places that may receive policy interventions**



Impact

The analysis has established mobile data compares well with existing sources and provides credible information on key outcomes of interest for evaluation, as well as generating early findings on EV usage for further investigation

Building models on big data

Department for Transport

4. Global Maritime Emissions Modelling

What will the global maritime fleet emit into the future and how can this be mitigated by policy options?

Analysis:

- Used **global AIS data** (ship positions) to understand what vessels are currently emitting for each vessel type/engine type/ fuel type
- Developed an **agent-based model** to understand how fleet operations will change in response to different scenarios
- Use this model to test different inputs to understand which factors will most affect vessel emissions into the future

Impact

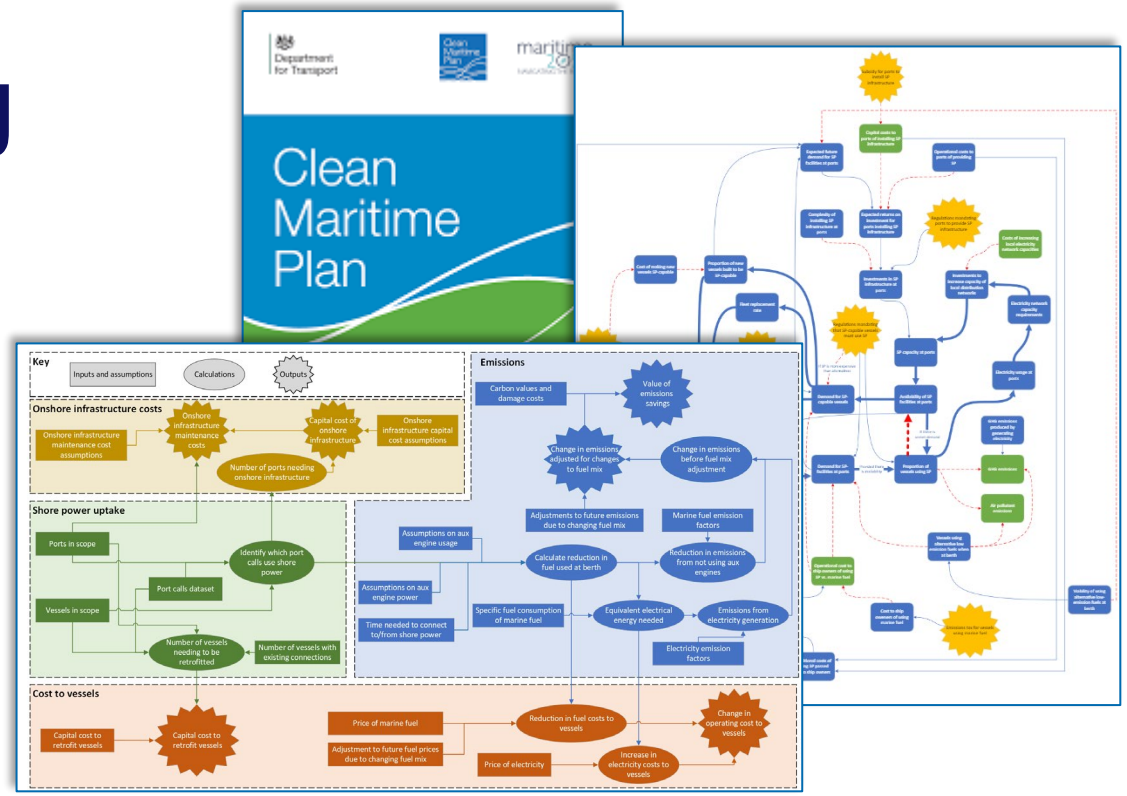
The model is feeding into the development of policies. It has helped increase our understanding of the make-up of domestic emissions and the interactions between global and domestic policy.

5. Shore Power Modelling

What are the costs, and potential emission reductions, of mandating vessels at berth to use power from mainland generators (“**Shore Power**”) instead of auxiliary engines?

Analysis:

- **Causal loop diagram** to identify key factors and scope, and highlight interactions and impacts not previously considered
- AIS and Clarkson’s port call data on all UK port calls and infrastructure costs allowed us to build a “bottom-up” **model of yearly emission reductions and costs**
- Model used to **test policy options** and **understand what happens** if mandates are targeted at specific vessel types or visit durations and frequencies

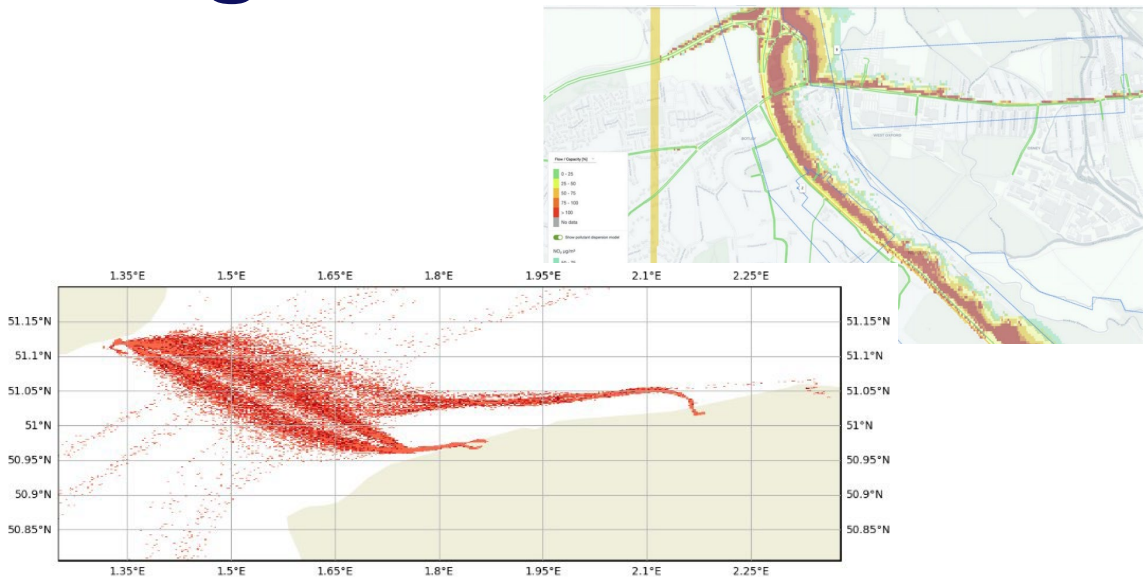


Impact

“The modelling has helped set the direction on what sorts of policies we could be focusing on and helped shape our understanding of what the gaps are for future analysis. [It has provided] better understanding of the barriers and challenges [to] ports and vessels using shore power.”

6. Decarbonisation through Digital Twins

How can Digital Twins support decarbonisation of transport?



Approach:

- **Various ways – including:**
- Enhanced manufacturing and technology integration
- Integrated asset management eg: EV chargepoints
- Network management:
  - Road sensor and AIS data to establish a cluster of AI road predictions and forecast the impact of maritime disruptions.
  - Between the two models we can have a complete "system flow" (road in/out, maritime in/out), can understand cascading events, their causes, and predict the extend of delays (level of disruptions, other locations).
  - Also using AI to identify casuality

Impact

Digital Twins have supported lowering daily pollutants through network management (up to 40% in Oxford), and improved machine efficiency (by 30% in Rolls Royce jet engines)

In 2023, UK Research and Innovation invested up to £20m to establish a Research Hub to Decarbonise Transport through Digital Twinning.

Thank you! Any Questions?

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